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ABSTRACT

The booklet contains learning activities for introducing energy and conservation concepts into the existing elementary school curriculum. The activities were developed by Palm Beach County teachers during a one-week workshop. A framework of ideas is divided into three functional categories: universe of energy, living systems and energy, and social systems and energy. The first two categories outline scientific concepts fundamental to an understanding of basic energy ideas and energy flow models of which human beings are a part. The third category sets forth basic concepts in social systems, including governmental, economic, and moral systems, the understanding of which is vital in making decisions affecting production, distribution, and consumption of energy resources. Sixteen sample lessons are provided for grades 1-3 and 19 for grades 1-6. Activity ideas focus on topics such as the sun as a source of energy, fossil energy, and conservation of scarce resources. The majority of activities consists of scientific experiments; other activities include puzzles, drawing exercises, and cut and paste activities. The activities are suggestive, rather than prescriptive; teachers are encouraged to adapt and expand the activities. (DRS)

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SAMPLE ENERGY CONSERVATION EDUCATION ACTIVITIES

FOR ELEMENTARY SCHOOL STUDENTS

Edited by

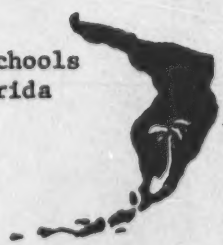
Rodney F. Allen
David E. LaHart

Florida State University
Tallahassee

SO 010 442

1977

Palm Beach County Schools
West Palm Beach, Florida



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[INTRODUCTORY LETTER FROM JOHN C. THURBER]

College of Education
Division of Instructional Design and Personnel Development
Program of Science and Human Affairs
Science Education
Social Studies Education

The Florida State University
Tallahassee, Florida 32306

November 4th, 1977

Dear Reader:

Few Americans in the 1970s have escaped the rising costs of energy. A stop at the gas station, a card from the public utility company, and a glance at the 6 o'clock news serve to remind us of the squeeze on our pocketbooks. Each of us has come more dependent upon fossil fuels and electricity, and the rising costs take greater portions of our disposable income.

Public service agencies —such as our schools -- are also caught in the soaring energy costs. Lights, air conditioning, and heating take larger chunks from the educational budget. Preparing school lunches and transporting children to and from schools compete with up-to-date textbooks, supplies, and aides for scarce resouces in strained school budgets.

Facing the costs of energy and the uncertainity of future supplies of fossil fuels, national leaders had proposed a plethora of plans and legislative action. State leaders have their plans and hopes. And local officials have encouraged conservation and public awareness. We are aware of these efforts from our daily exposure to the media.

Educational efforts, however, have not been so well publicized. Educators in national organizations, State agencies, and local school systems are beginning to mount conservation plans and to introduce energy education into the school curriculum. The Florida Energy Office has a Master Plan for Energy Conservation Education (Tallahassee, 1977) which spells out the following educational goals:

—To develop a citizenry which is aware and knowledgeable of energy issues, problems, concerns, and the energy alternatives available, and acts with an energy conservation ethic in its daily lifestyle;
—To develop a Florida State-wide energy education program which provides all components of the citizenry with an effective energy education program;
--To facilitate an effective energy education action program which combines the existing and potential resources of formal education, community citizens, governmental agencies and bodies, the private industrial/commercial sector, and citizen organizations;
--To facilitate energy conservation through the provision of a source of public funds to catalyze implementation of energy

conservation at the local community and school level;
--To develop public awareness through energy education that energy problems are symptoms of larger environmental/economic problems worldwide; and
--To reduce, through effective energy education and management, the consumption of energy in Florida.

These State program goals are complementary to those energy goals of the Palm Beach County Schools. One component of the Palm Beach Schools' plan is the introduction of energy education into the existing school curriculum, when and where it is deamed appropriate by teachers and officials..

The activities included in this booklet were written by Palm Beach County teachers in a one-week workshop program. The activities are not reprinted here as the "perfect set" of lessons which all teachers should use. They are the best products prepared by these teachers after a brief exposure to energy concepts and issues. They are reprinted as a reference for those participating teachers and are shared with other teachers as a means to inspire the creativity of those teachers. The finest compliment to the authors would be the adaptation and expansion of these activities into better and better activities for the children in Palm Beach schools.

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ENERGY EDUCATION SAMPLE ACTIVITIES/LESSONS: PRIMARY LEVEL

IDEA: Thinking about energy problems requires that we know energy words and word-meanings.

MATERIALS: Ditto sheets for each student with the following puzzle.

ACTION: Find the energy words:

bulb	dinosaur
waste	energy
sun	use
conserve	pollute
solar	light
fossil	heat
gas	off

G	U	L	S	A	S	T	U
D	A	Y	T	U	F	I	S
V	L	S	I	L	N	O	E
O	L	N	U	O	P	X	A
E	I	Z	S	B	O	F	M
N	E	A	T	E	V	F	O
E	U	L	I	S	S	O	F
R	E	F	R	T	A	E	H
G	N	O	W	A	S	T	E
Y	T	H	G	I	L	E	X
E	V	R	E	S	N	O	C
S	M	B	U	L	B	C	S
P	O	L	L	U	T	E	Y

IDEA: The sun is a source of energy.

MATERIALS: Two thermometers, Two plastic glasses of water, small squares of paper, a solar cube (solar fan)*

ACTION: #1 Fill each glass with an equal amount of water from the cold water faucet. Place thermometers in the glasses and take a temperature reading. Have students note these temperatures. Place the glasses outside: One in a sunny place, the other in the shade.

After one hour, return to the glasses and take a second temperature reading. Note the difference. Ask students to account for the change in temperature.

a)Has there been a change in temperature?
b)How can you tell?
c)Has the temperature risen? Dropped? Stayed the same:
d)How did this change occur?

(If thermometers are not available, students may note different temperatures by touch. Rocks and metal cans may also be used and differences in temperature noted by touch.)

#2 Place a solar cube (solar fan) on a classroom table. Ask students to identify what it does. Help them identify the parts: propeller, motor, wires, cells. As they make suggestions about its identity and uses, record the hypotheses on the chalkboard.

Then, have the students take the cube into a sunny place. Use the pieces of paper to cover portions of the cube, observing changes in the cube. Encourage students to explore what they can do to make the propeller turn or stop turning. Encourage students to try other light sources: flourescent bulb, incandescent bulb, etc.

#3 Ask students to sit in a circle outside or in the classroom. When seated, ask them to suggest all the ways that they can think of for using energy from the sun. Encourage children to talk about their ideas.

* Solar cubes (solar fans) may be ordered from the Ecology Shop, Silver Springs, Maryland

IDEA: Hot water is lighter and will rise, while cold water is heavier and sinks.

MATERIALS: Two clear glass soda bottles; food coloring; and a small square of cardboard.

ACTION: Fill one soda bottle with very cold water. Fill the second soda bottle with very hot water. Put food coloring in the hot water bottle (the darker the color, the better! Shake the bottle to mix the color.)

Place the cardboard square over the mouth of the cold water bottle, and turn that bottle upside down. Place it on the mouth of the hot water bottle...carefully removing the cardboard square.

Ask students to observe:

What happens?
Why does the colored water (hot water) rise into the cold water bottle? How do you know?

Going Further:

- If you were going swimming, where would you expect to find the warmer water: on the surface of the lake or near the bottom of the lake?

- If you were a skin diver going deep in the ocean, would you expect warmer or colder water as you went down to the ocean's floor?

IDEA: The earth has a limited amount of fossil energy, which people are using up faster and faster.

MATERIALS: A bag of dried beans (e.g., pinto beans, black beans); a ball of string; and a grassy place out-of doors.

ACTION: Select a bright, sunny day to go outside with the students. Find a pleasant, grassy spot. Use your string to outline a circle about twelve feet in diameter. Tell the students that the circle represents the whole earth.

Scatter a handful of beans unevenly throughout the circle. Tell the children that the beans represent all of the oil, coal, and natural gas in the earth.

Place ten children in the circle, as the "world's population." Each time you count to ten, each citizen of the world must find and pick up a bean, throwing it out of the circle. The bean represents the energy which they consumed in order to live. From time to time, add a child or two to the "world's population". Ask them to pick up beans after you count only to four, then after you count only to three.

As time passes, there are more people and they consume fossil fuels at a faster pace.

When a child cannot find a bean to consume, she/he must sit down. When many children are seated, stop the action and ask children to share their feelings. How did it feel to have to look quickly for a bean? How did it feel when you could not find a bean? Did people help one another to find beans.....or were people selfish?

IDEA: Hot air rises. Cold air falls.

MATERIALS: A candle or hot light bulb; a thin tissue; two thermometers.

ACTION: Light the candle carefully, or turn on an incandescent light bulb, waiting until it gets hot.

Carefully hold the tissue over the candle (not in the flame!) or over the hot bulb. Gently loosen your grip on the tissue. What happens? How can you account for what happens to the tissue?

Going Further:

- Place a thermometer near the ceiling of your classroom. Place another thermometer near the floor of the classroom. Which do you think will have a higher reading after one hour? Why?

  After one hour, check out your guesses by taking readings on the thermometers. Which had the higher reading? Why? How do you account for this?

- If you want to be warm on a cold day, where would you sit in the classroom? On the Floor? or On a Chair?

- If you want to be cool on a warm day, where would you sit in your classroom: on the floor or on a high chair?

IDEA: Once an energy source is used, it is gone forever.

MATERIALS: Matches; a fireproof transparent container; sample fuels (e.g. bits of scrap paper, corn husks, twigs, leaves, birthday cake candle, alcohol, etc.).

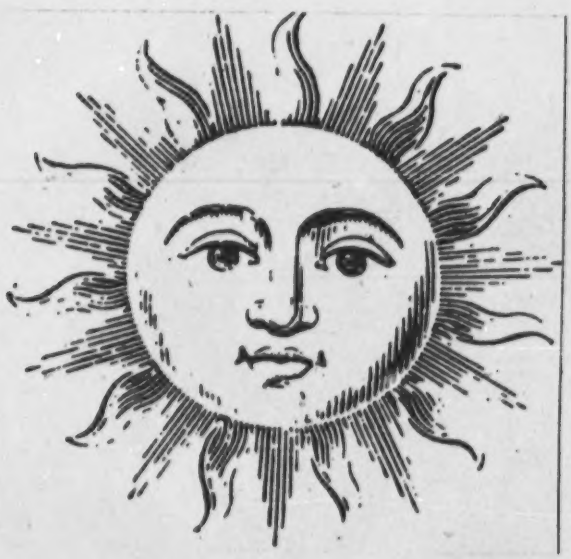
ACTION: Place small amounts of the sample fuels (one type at a time) into the fireproof cantainer. Light them and ask students to observe what happens: The paper is being used up by the flames; It is giving off heat; etc.

After the flame goes out, try to relight the remains. What happens? Why doesn't the material burn and produce heat?

Clean the fireproof container and repeat the burning with another sample fuel.

Going Further: Ask students to discuss the following: What happens if we burn up all of the gas at gas stations? What happens if we burn up all of the oil and coal in the earth?

Describe the plight of rural villagers in Third World Countries who have cut down all of the bushes and trees for miles around their village and must spend a large portion of each day gathering firewood or dried animal dung.



IDEA: The sun provides useful energy.

MATERIALS: Two one-gallon glass jars with lids; water from a cold water faucet; ten tea bags; two thermometers; sugar and lemon; a cup for each child; ice cubes.

ACTION: Have children fill the gallon jars with water (leave one inch air space at the top). Check the temperature and record for each jar. Observe the coloration of the water in each jar and record.

Place five tea bags in each gallon jar (suspend the tea bags in the water with the tags outside the jars). Screw on the lids...carefully so the strings on the tea bags will not be cut.

Have the students place one jar in the bright sunlight, and the other jar in a shaded place. After two or three hours, check and record the coloration and temperature of each jar's contents. Ask students to account for the differences in "shade tea" and "sun tea".

After the explainations, pour the tea over ice cubes, add sugar and lemon (if desired), and sit back to enjoy nature's bounty!*

Going Further: Ask students to discuss how we saved energy in this tea-making endeavor.

Ask if there are any other ways we can use the sunlight as useful energy.

Some students might like to think about ways to make the tea hotter or faster... Paint the jar black on one side, use mirrors, focus magnifying glasses, etc.....

* Return something to nature by recycling the tea bags into the soil outside the classroom.

IDEA: Light colors reflect sunlight, while dark colors absorb heat from the sun.

MATERIALS: Two cardboard boxes (one painted white, one painted black), two plastic milk cartons (one painted white, one painted black), four thermometers.

ACTION: Place the boxes and the milk cartons in the sun. Hang the thermometers in each box and carton. Ask students to record the temperature in each. (Interested children might feel the top of each container, at this time.)

After one hour in the bright sunlight, return to the boxes and cartons. Take temperature readings in each box and carton. Have students feel the tops of the two cartons and the two boxes. What difference do they observe? Ask them to compare the temperature readings for white and black boxes, and for the white and black cartons. Encourage them to explain the differences.

Going Further: The sun's energy may be used to dry clothing. Hang some clothes from the washer in the shade, and hang other pieces in the bright sun. Which do you think will dry faster? Observe the clothes every 15 minutes. Which clothes dried first? (Be sure that the clothes are of similar thickness and made from the same type of cloth!)

COSMIC COOKER

A learning expedition.

This experience may be adapted for a wide range of grade levels; rely on your students' imaginations for additional activities. Efficiency can be tested with a thermometer, and grades can be given accordingly.

Introduce solar energy by talking about its role in the development of fossil fuels, photosynthesis, and uses today.

Students can be divided into teams and graph, at various times during the day, temperatures reached in 5-, 10-, and 15-minute intervals. Efficiency lost or gained by adding more than one hot dog and changing reflector materials can also be checked.

Cosmic Cooker Plans

1. With the use of the pattern on the back of this sheet, copy two sectors onto a piece of ¼" or thicker cardboard and cut out. Voila'! The corners of your Cosmic Cooker creation can be considered complete.
2. Cut, chew, or chisel from a piece of poster board (2- or 3-ply) a rectangle 13½" by 8½" and fold, spindle, or mutilate it (if all else fails, tape it) to the sides of your super sunbaker of succulent sustenance.
3. Obtain a box that can house the above collector. One side of the box should be about 8-9 inches in length. Cut the top and one 8-9 inch side out and place the collector in the box, attaching with small bolts, nuts, and washers to hole B on sectors.
4. Rip off a coathanger from someplace and sit on it or stomp it until it's straight. Now steel-wool the skewer until all the paint is off. You will, when ready to cook, stick this through Hole A on your sectors.
5. Glue a piece of aluminum foil inside the concave aspect of the collector, with the bright side out. It should be noted that 3-ply poster board can be bought with reflective material on it. This works better than aluminum foil.

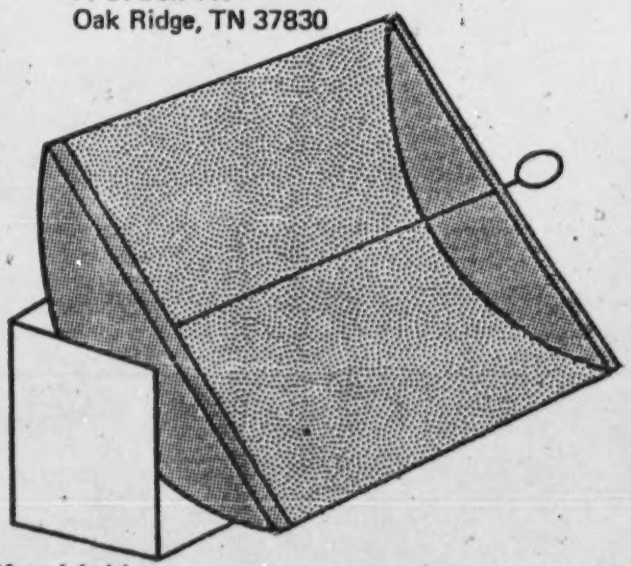
Take your skewer and stick it first through a sector, then through your defrosted dog, and then through the other sector (Hole A). Now wrap your dog or dogs with solar paper, black side out, and turn on the sun. To focus the cooker, look at the back side of the solar paper; when the cooker is in focus, the sun's rays will light up the back side of the hot dog.

The Science Education Resource Center is part of the American Museum of Atomic Energy in Oak Ridge, TN. The museum is operated for the Energy Research and Development Administration by Oak Ridge Associated Universities, which is a private, nonprofit research and education association of colleges and universities.

Suppliers (in case you would like to replicate the kit)

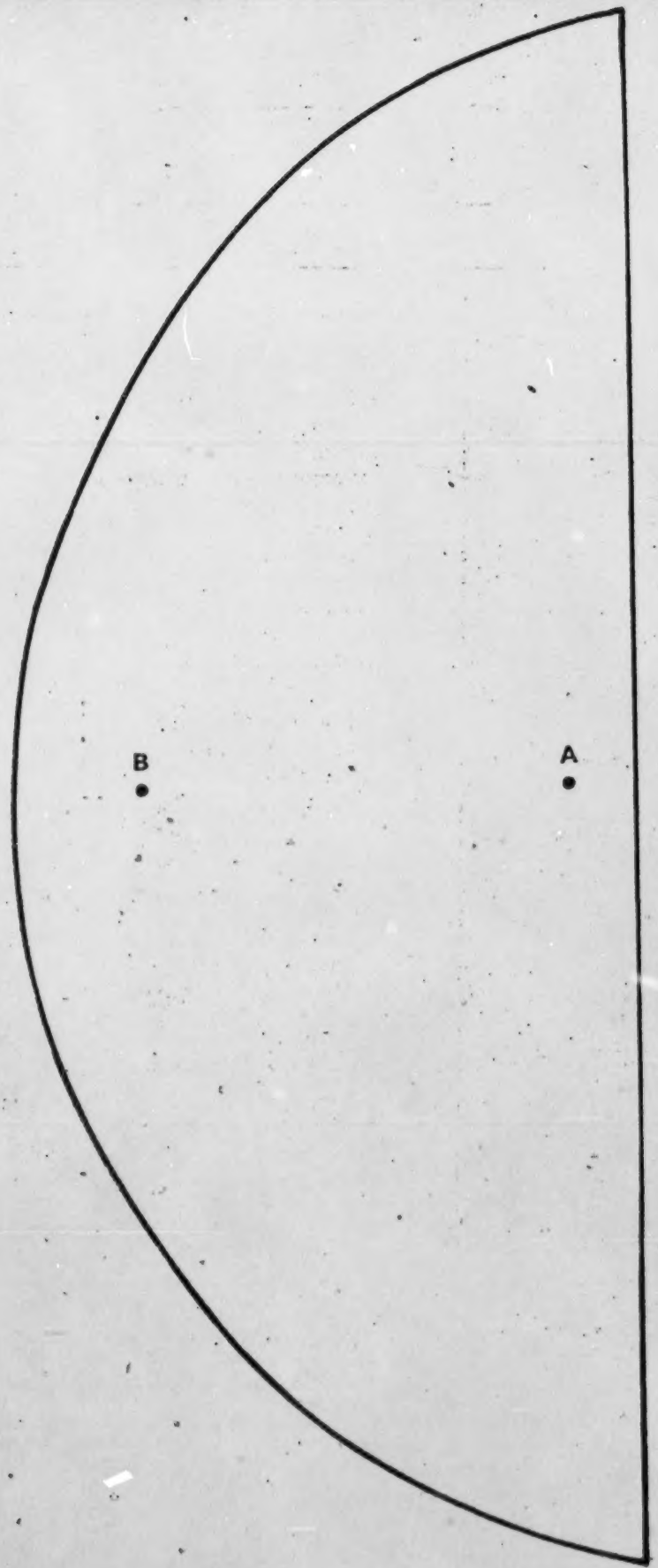
Item	Supplier
Cardboard sectors	Most stores
Coat hangers	" "
Reflector board or poster board	" "
Tape	" "
Scissors	" "
Aluminum foil	" "
Bolts	" "
Boxes	" "
Glue	" "
Solar paper	

The Discovery Shop
American Museum of Atomic Energy
P. O. Box 117
Oak Ridge, TN 37830



Materials List

[ ] Cardboard box
[ ] Coat hanger
[ ] Tape, masking
[ ] Tape, double-stick
[ ] Small piece ¼" cardboard
[ ] Aluminum foil
[ ] One piece of 13½" by 8½" poster board (3-ply)
[ ] Solar foil
[ ] Hot dog
[ ] 2 bolts, nuts, 4 washers


B
A

IDEA: How insulation conserves heat.

MATERIALS: Various types of insulation material such as paper, corrugated board, cloth, and styrofoam should be available for the students to use.

One ice cube per student or pair of students.

ACTION: Have the students plan how they might keep their ice cube from melting longer than anyone else. Give them time to plan. Let them carry out their suggestions. DO NOT tell them to use the insulation materials, but permit them if they ask. At the end of the activity, have those that were most successful share with the others how they kept the ice from melting and why they protected the ice the way they did.

To explore the social consequences of this phenomena, ask students to relate what they learned to decisions when buying the following items. "What would you think about when you and your parents are buying:

--a container to take coffee to a ball game?"
--an ice chest to go camping or fishing?"
--an oven for your kitchen?"
--a freezer or refrigerator for your home?"

IDEA: Heat travels throughout metals. Insulators retard heat travel.

MATERIALS: Metal rod or strip; hot water in a container; insulation materials (e.g., paper, wood, fiberglass, etc); clock.

ACTION: Pass the metal rod around for students to touch it at both ends. Ask them to record the warmth or coolness that they felt. Any difference from one end to another?

Have a student hold one end of the rod and submerge the other end in the hot water. The student should report when she/he feels the rod getting warmer. Other students should record the time, from inserting the rod in the water, until the student reports the rod getting warmer.

Let the rod return to room temperature (or have a second rod made of the same metal).

Wrap the insulating material around one end of the rod (e.g., newspaper tightly bound to the rod), then, begin timing when a student inserts the insulated end of the rod into the water. How long before the student reports the rod getting warmer?

Students should compare the time differences, and then, account for those differences.

Going Further:

- Compare the observations here with those made while doing the ice cube insulation acitivity.

IDEA: Conserving energy is often a matter of changing little things that we do in our daily life.

MATERIALS: Home bath tub with a shower head; adhesive tape which will stick on wet surfaces.

ACTION: Take a bath and, when you finish, use a piece of tape to mark the waterline (when you are out of the tub!)

Next time you bathe, use the shower. Before you begin, put the water stopper down so that the water you use will stay in the tub.

After your shower, compare the water level with the tape marker left from your bath. Which bathing experience consumed the more water? How do you know?

What conclusions about water and energy conservation can you draw from this experiment?

Going Further:

___ I can save water and energy when I wash dishes by:

___ I can save water and energy when I brush my teeth by:

___ I can save water and energy when I sprinkle a lawn by:

___ I can save water and energy when I get a drink of water by:

IDEA: Some things which people have use a lot of energy; while other things help people conserve energy.

MATERIALS: A stack of old magazines; safe scissors; large sheets of poster paper or newsprint; paste.

ACTION: Talk about things people have that consume (use) energy -- with the children sharing their ideas. Then, talk about things which help save (conserve) energe -- electricity, and fossil fuels.

USE ENERGY	HELP SAVE ENERGY
big cars	walking shoes
clothes dryers	clothes line
electric knife	hand knife
electric toothbrush	hand toothbrush
etc.....	etc.....

After the discussion, children should turn to the magazines to cut out pictures of "ENERGY USERS" and "ENERGY SAVERS". They can paste the pictures to make posters, and then, share their thoughts on the posters which they create, individually or in small groups.

Going Further: Students may want to make posters which remind others to conserve energy. Using the magazine stack, scissors, paste, and newsprint sheets, they can communicate their own message.

Other children may want to display their energy awareness through recycle artwork. Collect scrap on the school yard, at home or in the classroom. They can use those materials to:

--make weaving looms out of popcicle sticks;
--make banks and dolls from filk jugs and cans;
--melt crayons down into new ones;
--little bottles and boxes become storeage places;
--newspapers become paper maché;
--sticks and cans become rhythym instruments;
--old bottles become vases when covered with glued tissue paper;
--pop bottle tops become counters in math;
--old calendars provide numbers for math flash cards;
--etc.....

IDEA: The conservation of paper products is a way to conserve energy.

MATERIALS:
one pack of paper towels
one garbage bag
old bath towels
clothespins
glue
magic marker

ACTION: For one week, the children place the paper towels they use during the school day in a large garbage bag. At the end of the week the towels are counted and cost computed.

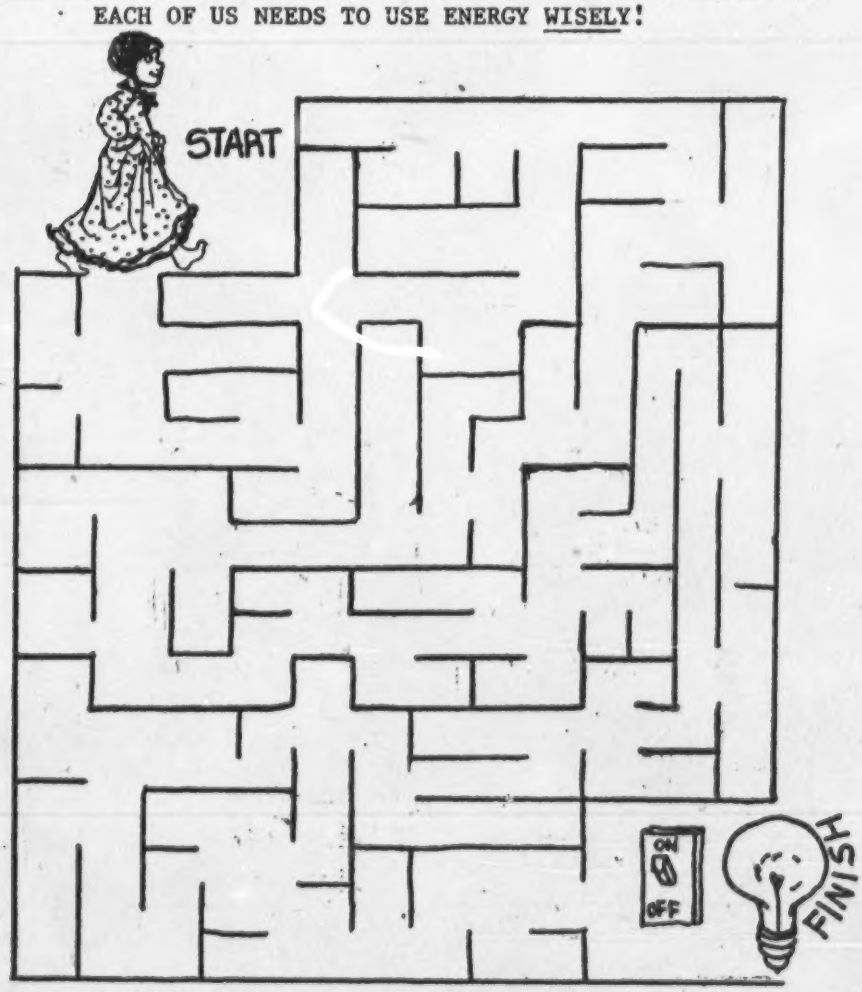
Clothespins are glued to wall, cupboard, board or any convenient spot (names of children written in magic marker on each clothespin). Old bath towels are cut into hand-towel sized pieces and clipped to clothespins.

The next week, children dry hands on cloth towels. Compute cost of soap, washing machine use (dried in sun of course), and figure savings in terms of paper, trees, and money.

IDEA: Each of us must learn to use home energy wisely. Conserving energy helps us to save resources, the environment, and money.

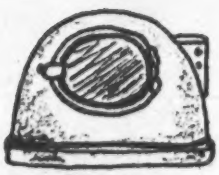
ACTIVITY #1: A worksheet maze activity centers on the need to turn off unnecessary lights.

HELP SUZIE FIND HER WAY SO SHE CAN TURN OUT THE LIGHT!!!
EACH OF US NEEDS TO USE ENERGY WISELY!



This activity sheet is reprinted from materials distributed by Palm Beach County Extension Home Economics Personnel.

ACTIVITY #2: CHOOSE THE ENERGY-WISE CHOICE!



Dryer

or

Clothesline

Car

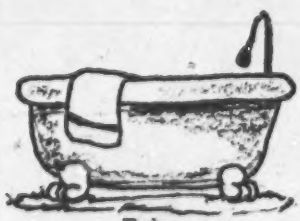
or

Bike

Sailboat

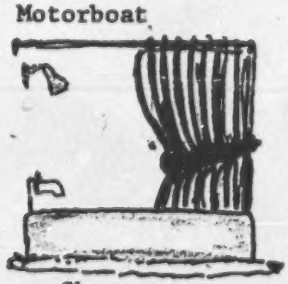
or

Motorboat



Tub

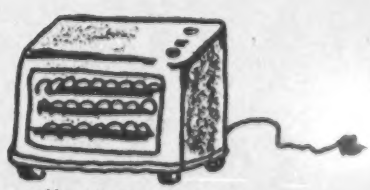
or



Shower

Sweater

or



Heater

IDEA: People in different eras have used different energy forms and different amounts of energy.

MATERIALS: Photographs, slides of paintings, books with historical artwork, etc., and equipment to show these visuals to the class(e.g., slide projector, opaque projector, etc.).

ACTION: Show pictures (slides, paintings, etchings, etc.) of historic and contemporary humankind. Compare the energy being used in the graphic. Ask students to identify the energy source being used (e.g., food, chemical, mechanical, nuclear, electrical, etc.).

Ask students to discuss why people in the slides were using that form of energy.

Ask students if they notice any relationship between the era of the people and the kind and amount of energy being used.

GOING FURTHER:

- Use only slides (photographs from books) showing human beings in the contemporary world--but in various places and cultures (e.g., Australian aborigines, New York businesspersons, Canadian farmers, British fisherpersons, Saudi oil workers, etc.,). Again, ask students to identify the energy source and the amount consumed. Ask students to relate their observations to the lifestyle of the people.

- Divide the class into groups. Have each group portray the ways people used energy in the past, or in other cultures. Children may make up stories to go with their portrayal/skits.

- Have students cut out magazine pictures and put up a bulletin board on energy use. They might do a timeline for energy use in America.

- Have students cut out or draw pictures for a bulletin board on energy conservation in America.

IDEA: Persons in different eras used different forms of energy in building a daily life-style.

MATERIALS: Library books on explorers, social studies textbooks, and graphic encyclopedias.

ACTION: Ask students to form groups of two or three and ask each group to select an explorer from a list the teacher has written on the chalkboard.

Each group is responsible for looking up "their" explorer and find out what s/he discovered. They must also find out what energy forms s/he used in the exploration.

e.g., Columbus. "Discovered" America. He used a sailing vessel. Energy: wind, human muscles (food).

e.g., Neil Armstrong. "Discovered" the lunar surface. He used a rocket and space craft. Energy: human muscle (food), chemical energy, and electrical energy.

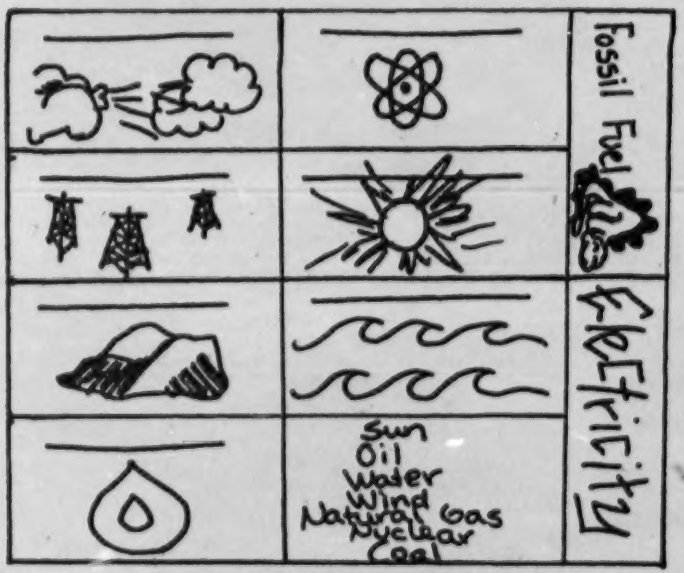
After students have finished their initial inquiry, let them report to class. Conduct discussions on such questions as :

Why didn't Columbus use rockets?
Why did he use wind energy?
Pretend that you are an explorer. What form of energy would you use? Why?

IDEA: Energy comes from a variety of sources and in a variety of forms. Humankind has drawn upon these sources in many ways.

MATERIALS: The following chart on a ditto, scissors, paste, crayons, construction paper.

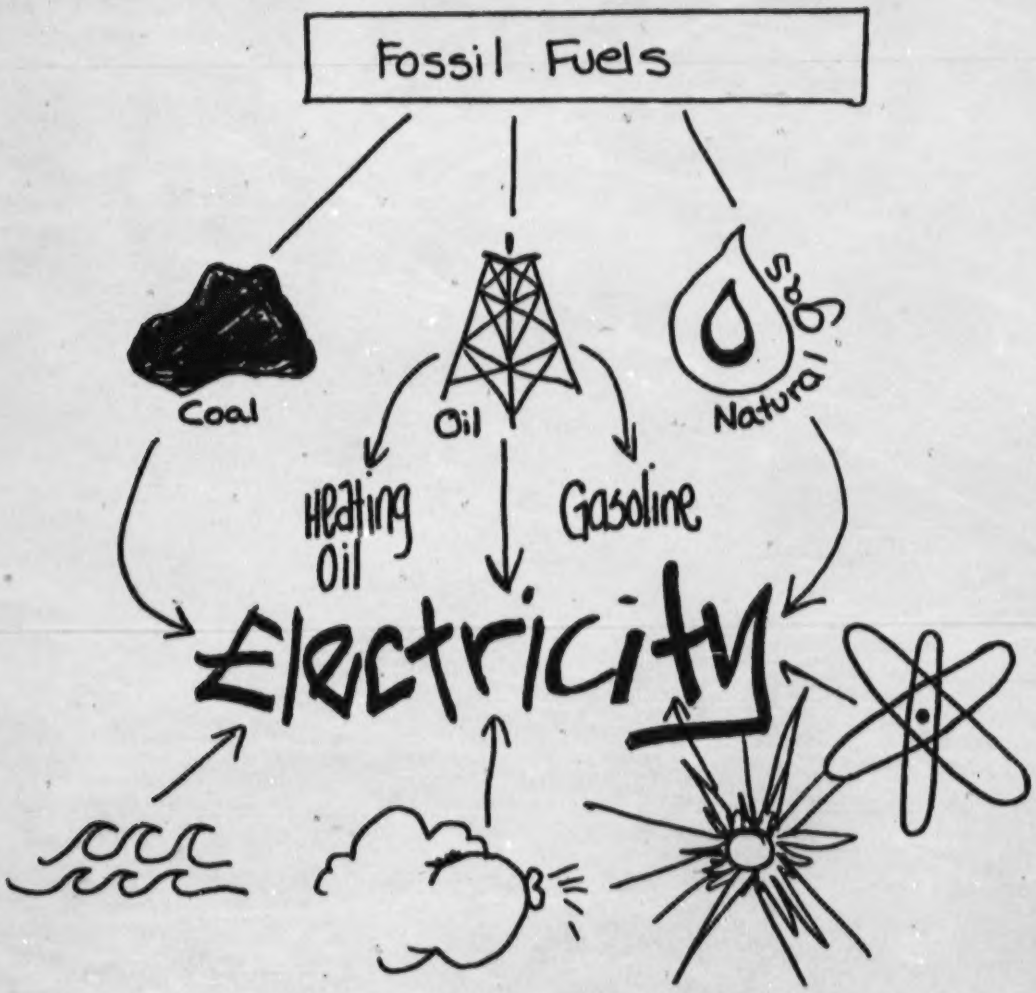
ACTION: Match the names of the energy sources to their picture.



Discuss the concept of fossil fuels. How they were made. How many years it took. Where they are found. Make the following chart by cutting up the ditto and pasting the parts on construction paper. Also bring in the point that heating oil and gasoline come from oil and add that to chart.

Define the word "electricity". Make a list on the board of all things that the children can think of that need electricity and add it to the chart.

Discuss the energy sources that make our electricity by drawing lines to the word electricity from each energy source. Add the rest of the energy sources to chart and do the same.



Develop the concept that we use more of some energy sources to make electricity than others. We use more oil to make electricity than we do others so put a #1 in the oil box, #2 in the natural gas box, #3 in coal box, #4 in water box, and #5 in nuclear box. At this time scientists are working on ways to use the sun and wind inexpensively and effectively.

Put a red circle around the energy sources that are running out: oil, natural gas. What does that mean to us?

Outline each source in black for an energy source that causes some type of pollution when it is used:
Coal Oil Nuclear

What does this mean? What energy sources are left?

Discuss the ways that each of us could try to save energy.

IDEA: While light is necessary in a classroom, there may be alternative ways to light a room...ways that save electrical energy.

MATERIALS: Classroom, pencils, and scrap paper for each student.

ACTION: Ask students what makes the lights in the classroom work. Ask them why we have such lighting in classrooms. (Encourage all answers and note them on the chalkboard).

Ask students what other ways of lighting the classroom might be, and again note answers on the board.

Turn off the classroom lights. Ask students to rank order the alternatives which they mentioned from Most Desireable to Least Desireable. Have them share reasons for their rank ordering.

GOING FURTHER: Using scrap paper, have students design classrooms using natural lighting. Discuss the advantages and disadvantages.

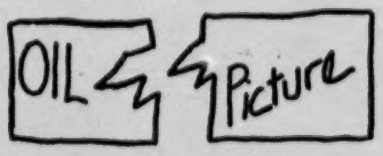
Do a lighting survey at home. What kinds of lighting is used? List places with "too little lighting"--and how this might be corrected. List areas with "too much lighting"--and how this might be corrected.

IDEA: Communication about energy problems and issues requires practical knowledge of energy words and word-meanings.

MATERIALS: A stack of old magazines which have color photographs; scrap paper(e.g.,computer cards, computer paper, scraps from a local print shop)

ACTION: Develop a list of energy words. Have students write one of the words on one-half of a card, mounting an appropriate picture on the other half.

Later students may scramble the cards and have other students put the proper halves together.



Students will prepare "bingo"boards, chips, and cards with energy terms. Cards will be drawn from a hat and the energy terms called-out. Students will look for the written word on their "bingo" board and, if the card has the word, they will put a chip on it. The first person with ten words wins....and draws the cards from the hat during the next round.

Sample words:

Fossil	asphalt
conservation	coal
energy	hydro
atomic	geothermal
methane	natural gas
windmill	tidal
generator	wave
pipeline	wing
watt	heat
potential	electricity
oil	coal dust
gas	nuclear
sun	dam
solar	
fuel	
power	
gasoline	

IDEA: Fossil energy is unevenly distributed across the earth's surface, with some nations poor and others with great abundance.

MATERIALS: A ball of white string, a bag of beans, (e.g., pinto beans, black beans), a bright grassy area out-of-doors.

ACTION: Take the class outside to a bright, grassy area. Use the string to lay out a circle about 15 feet in diameter. Use the string to divide the circle into small and large "countries".

Place students in those "countries". Make the population uneven: one person in a large country, three persons in another country so small that it is hard to stand in its borders.,etc.

Tell students that they need energy to survive. Take a handful of beans to represent modules of "fossil fuel." Scatter the beans unevenly throughout the nations: three beans in a small, heavily populated country, a lot of beans in a big country, etc . Persons left standing outside the circle are heavenly observers. They must observe the behavior of those energy consumers on earth.

Begin the action by having each person pick up and "consume" a module of energy. After three seconds or so, call for another pick-up to denote energy consumption. Now, pause to add to the population of some countries. Resume energy consumption..... and continue several more minutes. When a population can't find beans, the people must sit down.

GOING FURTHER: What did you see? Do people in nations with little energy get anxious? Unhappy? Do they reach across borders to get energy? Do others share energy? How do you account for these behaviors?

Use encyclopedias to compare population size and fossil fuel resources in several nations:

Canada	United States	India
Kuwait	Japan	Nigeria
Israel	Germany	Chile

IDEA: While we are known for our desire to have conveniences, we are also known for our American ability to adapt to new situations. This ability to adapt can help us adjust to the higher cost of energy and the reduced supply of some fossil fuels.

MATERIALS: Pencil, paper, and a dittoed chart (see below) for each student.

ACTION: Determine how many things you have in in everyday life that are really conveniences, and could be supplemented or done away with.

ITEMS	CONVENIENCE	NECESSITY	ALTERNATIVE/SUPPLEMENT
television			
radio			
water heater			
electricity			
indoor facilities			
carpeting			
electric clocks			
dishwasher			
wall heaters			
clothes dryer			
washing machine			
air conditioner			

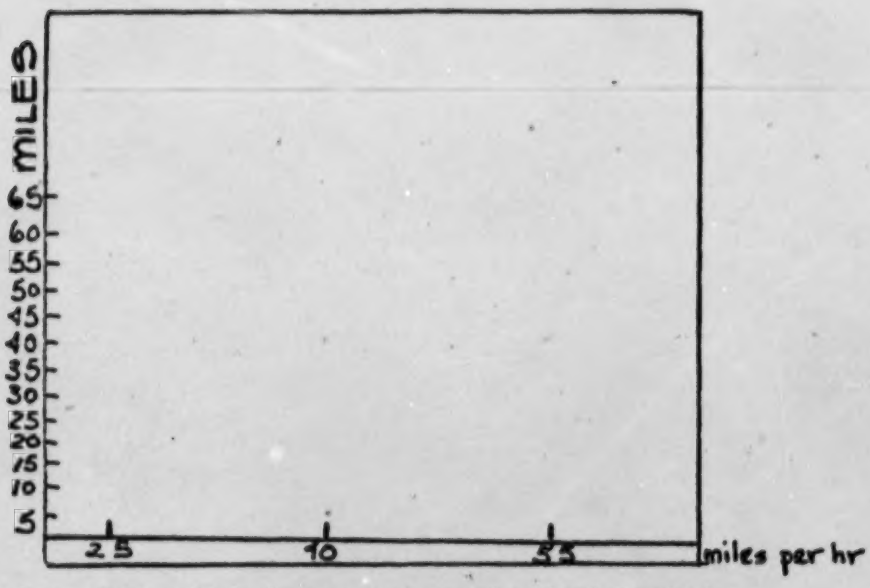
GOING FURTHER: Develop a plan for energy/dollar savings. See what you could do without and figure out what this would save in dollars.

You might have a "Pioneer Night" at home with your parents, using as little energy and as few of the convenience items (list above) as possible. How does it feel?

IDEA: How does the regulation of the speed in an automobile affect fuel consumption?

MATERIALS: Automobile, fuel (sufficient fuel in a spare can to use exactly 1 gallon of fuel for each experiment and have enough to get home), Open highway.

ACTION: Drive the car at given rates of speed: 25mph, 40mph, and 55mph. Use exactly 1 gallon of fuel each time. Record how many miles were obtained on each gallon. Record your findings on a chart or graph.



Once you have determined the rate of speed and plotted the mp gallon which are most economical and practical on the open road, you can drive at that speed.

GOING FURTHER: Before the family car is tuned-up, check the odometer reading before and after filling the car with gas. Compute the miles per gallon of gasoline. After a tune-up, compute the gas mileage again. What do you discover? Did the mileage increase or decrease?

IDEA: Darker colors absorb greater amounts of solar energy than lighter colors.

MATERIALS: Five thermometers, five different color sheets of paper (including black and white) of equal thickness, a warm, sunny spot out-of-doors.

ACTION: Go outside to a warm sunny spot. Place the five thermometers on the same surface (e.g.,on grass). Then cover each thermometer with a different color sheet of paper.

Students might offer predictions about what will happen under each sheet, as the sun shines and time passes.

Come back to the area after one hour. Remove each sheet of color paper and record a temperature reading. Have students check out their predictions. Ask them to note differences in the five temperature readings. Then, they should account for the differences.

GOING FURTHER:

- Try the same experiment again, using a bright sheet of aluminum foil, and a sheet of foil with a blackened side up toward the sun. Have students make, and then, explain their predictions. After an hour, check the temperature readings. Were the students successful predictors? Did energy knowledge transfer from one situation to another?

- What choice would you make if:
  --You were picking out new summer uniforms for a school band. You can choose white or black uniforms.
  --You were picking out a new car. You can choose a tan roof or a dark blue roof.

IDEA: Does color make a difference? Could the color of a roof make a difference in the temperature of your house?

MATERIALS: Go to the supply area and bring back to your work area the following items:

energy house
1 thermometer
1 thermometer holder
1 heat source (sun or sun lamp)

ACTION:

ACTIVITY #1: Place the thermometer in the middle thermometer holder. Place the roof on the house with the white side facing out. Place the house in the sun or under the heat lamp. Wait 5 minutes and take the temperature of the air inside the house.

ACTIVITY #2: While you are waiting answer the following questions:

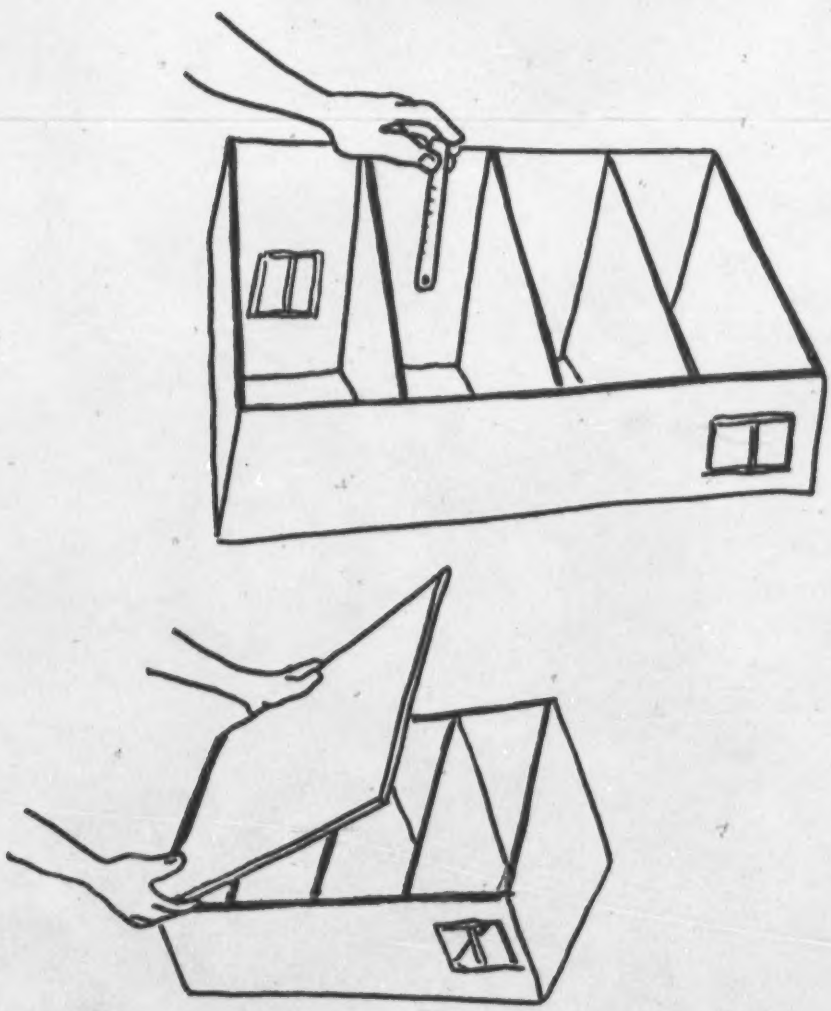
1) Do you think that the temperature of the house with the white roof on will be higher than the temperature of the house with the black roof? Why?
2) What type of graph will you draw to show the difference in temperatures in the house? Make two graphs while you are waiting for the temperature to change. Make a graph showing what you think the temperature difference will be. Using the thermometer readings, make another graph showing the actual reading.
3) What statements can you now make about the value of having a white roof if you live in Florida?

GOING FURTHER: Work in small groups to list as many things that you could do to make a home cool in a warm climate or warm in a cold climate. Share your lists with one another.

With your teacher's and your parents' help, arrange to talk to home builders, insulation installers, nursery owners, and other community workers about your list. Ask them to help you add to your lists. Get

them to help you to figure out how much each item on the list would cost in your home.

Work with your principal and/or custodian to figure out ways to make your classroom cooler in warm weather and warmer in winter.



IDEA: The wind is a source of mechanical energy.

MATERIALS: Miniature windmill with leader going to the gears of a meter. Model windmills may be ordered from:

The Ecology Shop
1520 Gridley Lane
Silver Springs, Maryland 20902

ACTION: Take windmill containing leaders going to the meter in a windy area to observe what would happen as the windmill turns. Students will write down meter readings after teacher tells them how to read a meter. Then they will observe the windmill turn the gear at the base of the windmill, the change of the meter reading and take a new reading at the end of the observation.

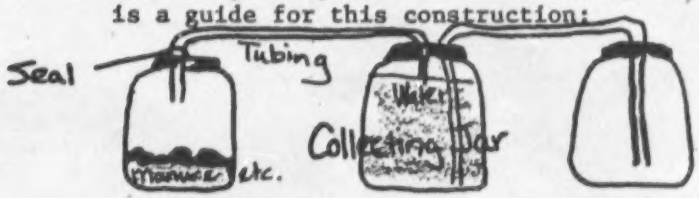
Vocabulary for new word meanings:

windmill	energy
meter	generate
gear	wind
rotation	reading
observe	

IDEA: Energy can be obtained from many sources, which may seem unusual to us. For example, gas may be made from garbage.

MATERIALS: A model Methane Digester (which can be home-made), bunsen burner, three gallon jars (with lids), grass clippings, cow manure, cooked food wastes, uncooked food wastes, etc., two plastic hoses.

ACTION: Work with students to build at least one methane gas ingester. The Following model is a guide for this construction:



Now that your methane gas ingester is ready, measure the best amount of manure, grass, etc., and water together. Mix well. Put in the ingester (Jar #1). Place the ingester in a warm place and wait a few weeks for the production of gas. At that time, take the burner and connect the hose from the gas jar (#3) to it. Light the burner and heat some water as a demonstration.

GOING FURTHER: Build a second methane gas ingester to make comparisons of the gas productivity of various "charges": grass clippings, food waste, leaves, etc. Or use two ingesters to compare environments: one working in an air conditioned room or refrigerator and one in a warm sunny place.

Discuss the practical applications of such a system for a school or office building of for a farm. Don't forget to note the use of the mixture as a compost for soil.

IDEA: Wasting hot water, wastes both the fresh water and the energy used to heat the water.

MATERIALS: A hot water faucet in the classroom or laoratory which may be allowed to drip for a few minutes, a clock, different kinds of measuring devices (e.g., a cup, some plastic jars, and a calibrated cylinder)

ACTION: Have students observe the dripping hot water faucet. Ask them to identify a problem. Students should share ideas.

Students should determine how much water is being lost. How would you measure water loss using the materials provided by you teacher? Discuss your plans with another student, then do it.

Note to teacher: Get student to design and carry out an investigation to determine water loss. They will need to consider time and volume measures. Let them first attempt to solve the problem and then you raise the need for their establishing standard measuring devices. If some students collected a cup of water in 10 minutes, while another 300ml in 12 minutes, they have a problem in comparing data. Have the students establish a standard, such as the amount of water that will be wasted in 10 minutes, or how long does it take to collect 250ml of water.

Compare your information on the amount of water lost with another student's information. What problems do you have in making comparisons? Discuss with your teacher the problem of comparing information with the rest of the class.

GOING FURTHER: Have you seen dripping hot water faucets before? Where? What did you do? Why did you do that?

Develop an action plan to correct drippy hot water faucets at home or in school. You

might begin by doing a "Drippy Hot Water Faucet Survey" to see how many dripping faucets you have in school or at home.

Pretend that you are a guest at Sally's home. You see hot water faucets in her kitchen and in her bathrooms which are dripping. You do not want to hurt her feelings. But what do you do?

IDEA: Wasting hot water, wastes both the fresh water and the energy used to heat the water.

MATERIALS: Several old water faucets, washers, seats, wrenches, and screwdrivers [Get old faucets from your local plumber!]

ACTION: Say to students, "This faucet was removed because it was dripping." Ask them to identify an energy problem. [Students share ideas]

Activity #1: Try to determine —using the tools and the faucet provided -- what parts are damaged and need replacement. Discuss your plan of action and your findings with other students seated nearby.

Activity #2: Examine Figure #1 and try to replace the worn parts in your faucet. What problems do you find? Check with your teacher to see if the parts are replaced correctly.

Diagram of water faucet and washers was removed by ERIC due to copyright law.

Figure #1 [New York Times, Sunday, June 15, 1975, p. 35D]

Going Further:

- Whatelse in your home, besides a faucet, controls water flow? Where? How many? Any leaks? What did you do?

- Look at Figure #2. What parts have you seen before? What parts or areas in the water closet might cause problems and need replacement?

- Pretend you are a plumber. Use Figure #3 as a guide to fix your leaky ballcock valve!

- Pretend you are a plumber. Call a local plumbing supply shop to check the prices of parts you will need to replace in the ballcock value. Check the price of a new ballcock assembly. What do you learn from checking these prices?

Diagrams of ballcock valves were removed by ERIC due to copyright law.

Figure #3

-Figure #2 [Step By Step Guide for Installing and Repairing Home Plumbing. Morgantown, West Virginia: Sterling Faucet Company, 1971.]

IDEA: Can solar energy propel a fan?

MATERIALS: 10 solar cubes (for a class of 30)
These may be ordered from:
Gerry Schneider
The Ecology Shop
1520 Gridley Lane
Silver Springs, MD 20902
Phone: 301-649-2304.
Class session will be outside.

ACTION: Divide the class into groups of three. Each group will have a solar cube.

ACTIVITY #1:
Cover the cube with your hands. Does the fan move?

ACTIVITY #2:
Now uncover the cube. Observe the fan. Is the fan moving now? What do you think is making the fan move?

ACTIVITY #3:
Tilt the top of the cube so that it is away from the sun. What happens to the fan? Is it moving as fast as before? Why is the fan moving slower?

ACTIVITY #4:
What do you think will happen to the speed of the fan if you tilt the top of the cube toward the sun?..Now, tilt the top of the cube so that it is receiving direct rays from the sun. Is the fan moving faster or slower? Why do you think the fan is moving faster?

ACTIVITY #5:
What causes the fan to move? Why won't the fan move when you cover the top of the cube? Why does the fan move faster when the top of the cube is directly exposed to the sun? How could this cube (and fan) be used to provide energy around your home? This fan is moved by solar energy. Does anyone know what solar energy is? Could solar energy be used in your home? How? Would you want solar energy in your home?

GOING FURTHER:
How will our ideas, gained here, affect you? Will you act differently about using energy? Will your actions have an effect on others? Has a person really learned, if he or she does not change his or her way of acting?

IDEA: Solar energy
How can solar energy be used by man to meet his future needs?

MATERIALS: A large open area outdoor and bright sunny weather. A solar/cube for demonstration.

ACTION: Take a group of children outdoors on a bright sunny day. Sit in a circle. Pass the solar cube around. Examine it, share your curiosity with classmates, ask questions, etc.

Return to classroom. Continue the large group discussion on our solar energy and how the sun may be our answer to our need for a new source of energy.

Form small committees. List topics of interest for each committee to research on solar energy and how it can be used for man's benefit.

Draw conclusions on data collected and making judgements about changes that must be brought about to tap the sun's energy. Example: Architectual design of buildings, homes, color of clothing, homes, distillation, solar engines, cookers, heaters, furnaces

ACTIVITY #1:

Make a box showing the principle of solar water heaters. Use a cigar box. Coat the inside with several coats of dull black paint. Cover the top completely with a piece of glass. Put a room thermometer inside the box. Cover the upper edge of the box with a thick layer of modeling clay so the glass will fit tightly. Take the box outdoors and lean it against an upright stick so that the rays of the sun will strike it at a right angle. Record the temperature shown on the thermometer. With another thermometer record the air temperature outside the box. Keep the temperature recordings for several hours.

ACTIVITY #2:

Draw sketches of future home designs. Show roofs and sun exposures. Water heaters using solar energy.

ACTIVITY #3:

Make a survey of your community. Are solar heaters available? How? Where? Cost? How many homes are using form of solar energy?

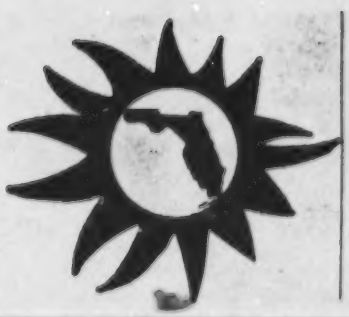
ACTIVITY #4:

This is a list of some questions that grade six science class actually asked after examining the solar/cube. How would you answer these questions?

1) What is it?
2) What does it run on?
3) Could it become one of our major energy happenings?
4) What makes it go around?
5) What makes the sun effect the little black things?
6) How is it made?
7) Was it made by a scientist?
8) What makes the thing spin?
9) Will it run in regular light as well as sunlight?
10) Could it be used on an airplane?
11) Could you be able to conserve energy?
12) Can it go faster if it is bigger?
13) Is it run by solar energy?
14) What does it do for people?
15) Why does it stop working when it is out of the sun?
16) How could it be used?
17) How does the sun make it run?
18) Why doesn't it work indoors?
19) Is it something to do with heat or energy from the sun?

GOING FURTHER: Subjects for student library research that are related to solar energy:

1) Solar house heating
2) Solar furnaces
3) Solar batteries
4) Solar distillation
5) Need for solar energy
6) Solar cookers
7) Solar boilers
8) Future uses of solar energy
9) Electricity from solar energy
10) Effects of solar energy
11) Solar water heaters
12) Solar generators
13) Solar air-conditioning



IDEA: Solar cells generate electricity from light.

MATERIALS: Solar fan cube, sunlight and/or incandescent light source, vocabulary list, magazines, paste, construction paper, and tin foil.

ACTION: Have students observe the solar fan cube. Ask them to find things out about it. What makes it work?

ACTIVITY #1: Discuss concept of electric current when exposed to treated silicon discs. Have small groups speculate on uses of this type of energy production.

ACTIVITY #2: Have small groups try to think of ways to use this type of energy production. Allow time for reflection. Groups may report their findings to the whole class.

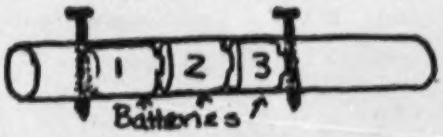
GOING FURTHER: Cut out pictures from magazines of various objects being powered by energy, other than solar. Determine best position of solar cells (batteries) and paste tin foil in respective positions.

IDEA: The sun's rays can be converted into electricity.

MATERIALS: Solar cube, compass (Direction-indicating variety), wire (the thin kind found in discarded telephone cables will do nicely), three flashlight batteries, cardboard tube about 2 inches longer than the three batteries, 2 nails, 2 round head bolts 3/4 in. long, 6 nuts to fit the same

ACTIVITY #1:

Construct a battery holder as shown:



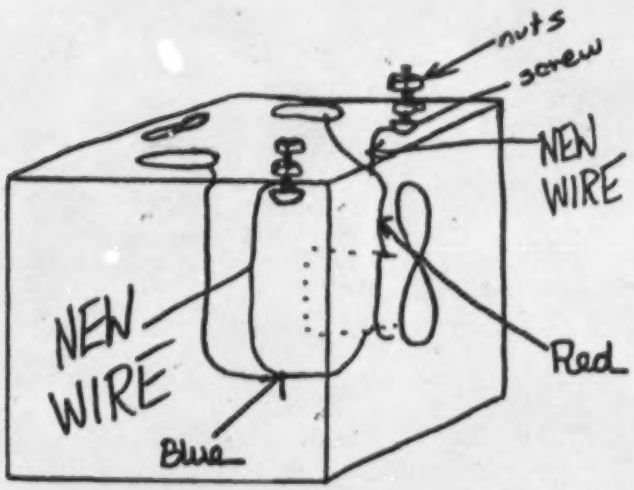
The nails should force the batteries tightly against one another. If you want to go first class, beg, borrow, or steal 2 alligator clips from some electronics-type individual. They will be used to hook the batteries up to the wire. If this is not available, just twist wires together where needed. Take a piece of wire 18 inches long (40cm) long and make loops (4) around the compass thusly:

Attach one end of the wire to one of the nails. (The wire should be insulated, the ends need to be stripped of insulation back one inch) Touch the other end of the wire to nail # 2 and observe the deflection of the compass needle. Increase one decrease the number of twists of wire until you get a needle deflection of 60°.

Have someone modify the solar cube as follows:

Drill 2 holes in the top-front edge of the plastic case at a point near the 2 front corners. Insert 2 small round head bolts into the holes and have wires spliced into the red and blue heads on the motor. Secure the wires to the

bolts by tightening them up with one set of nuts. The other 2 are used to secure wires from the compass system to the solar cube. See diagram.



This set-up will allow you to measure the electrical output of the solar cube. Hook the 2 ends of the wire wrapped around the compass to the 2 screws. When exposed to various forms and intensity of light the output of the solar cells can be compared with the batteries. By removing one battery at a time from the pack, you can calibrate your instrument for 1 1/2,3, and 4 1/2 volts.

ENERGY CONSERVATION IDEAS FOR HOME AND SCHOOL

Turn off all lights when leaving any room, even for a little while.

Turn off unused equipment, e.g., record players, projectors, etc.

Don't leave water faucets running. Report any drippy faucets.

Turn off heaters and air conditioners at the end of the day.

Turn off unnecessary lights.

Unplug TV sets which are not in use.

Keep doors and windows closed, if the heater or the air conditioner is on.

Eliminate unnecessary outdoor lighting.

Avoid use of hot water when possible.

Never let a hot water faucet drip...or a cold one!

Use a teakettle --not a pan--when heating/boiling water.

Use no-iron fabrics and eliminate ironing.

Use cold water for laundry and housecleaning chores --it saves energy and some cleaning products work better in cold water.

Line dry clothes.

Make use of natural lighting--keep your windows clean.

Dirt absorbs light. Keep your light bulbs and light fixtures dusted.

Don't waste energy heating and cooling closets, unused rooms, or storage areas. Keep the doors closed and cut off heating/cooling vents.

Keep furnace and air conditioner filters clean. Don't block registers with furniture or drapes, etc.

Prop-open doors in warm weather to get an air flow without running the air conditioner.

Give light dimmer switches as gifts on holidays or birthdays.

Recycle old envelopes for sending messages to children's homes.

Help establish neighborhood recycling centers...aluminum cans, paper, etc.

Establish a maintenance suggestion box for energy saving ideas.

Recycle old paint brushes, using them as the structure for dolls.

Open windows, if you have any, instead of using the air conditioner.

Use centralized areas for after school activities --cutting off lights, heat, and air conditioners in other parts of the school.

Make buttons from old plastic margarine lids [Magic Marker an energy saving slogan, then heat lid in a warm oven to reduce it in size... use an oven immediately after cooking, to save energy!!!] WATT-WATCHER.

To save ditto paper, have students write on ascetate overlays which may be cleaned for reuse.

At lunch time, conserve napkins and towels by passing out one (or 1/2) to each child. Do the same with straws, too.

Borrow a light meter to survey light brightness in schoolroom and at home. Reduce brightness, if it is excessive or unnecessary. Pay special attention to hallways, cafeteria, gym, etc.

Use both sides of paper in school work. Contact a computer center or a print shop to obtain "scrap paper."

Do a lot of "junk art" --using waste materials from the cafeteria, classroom, school yard, home, etc.

Use the chalkboard more to save on paper useage.

Place tape over one light switch when there are two or more in the room and one set of lights is adequate.

Replace paper towels with individual terry cloth towels brought from each child's home. Build a towel rack to hold them.

Do energy audits in the classroom, school wing, or whole building. See what energy is used. When it is used. How it may be saved.

Conserve school materials --paper, crayons, pencils, books, chairs, etc. --to save money, energy, and taxpayers.

Encourage brown bag lunches to save peak load energy use in school -- when children can and do get hot meals at other times in the home.

Encourage school stores to buy in bulk (saving all of those little wrappers) and to stock only non-junk foods (e.g., fruit, nuts, etc.).

Check out the school's heating system and water heater, with the maintenance person assisting. What system is used to insure maximum efficiency?

Monitor speed of school buses.

Check the "fit" of school windows and doors.

Do we need hot water in the restrooms far from the water heater? Are the hot water pipes insulated?

Save on the use and cost of energy for commuting. If public transportation isn't available, try carpooling or vanpooling to and from work. You'll save on car maintenance costs and parking fees as well as gasoline.

If you haven't already done so, have your oil furnace serviced soon. This simple precaution could save you 14 percent or more in fuel consumption.

Don't waste energy by using your full-size oven or broiler when cooking small meals. Electric skillets, bake ovens or toasters often are more convenient to use -- and they cost less to operate because they use less energy.

Don't over-ventilate your kitchen or bath. Use vent fans sparingly. A fan running needlessly wastes electricity.

Is your car due for a tunenp? Have it done soon. Regular tuneups extend engine life and improve performance. A poorly tuned car could use as much as 3 to 9 percent more gasoline than a well-tuned one.

Save on electricity and lighting costs by light-zoning your home. Concentrate bright lighting in reading and working areas and where it's needed for safety. Reduce lighting in other areas, but make sure you don't leave them too dark -- there shouldn't be very sharp contrasts between working and surrounding areas.

Help your clothes dryer use less energy. Separate drying loads into heavy and lightweight items. Since the lighter items take less drying time, the dryer doesn't have to be on as long for these loads.

Reduce energy consumption in cooking. Use pans that entirely cover the heating element. This way more heat enters the pot and less is lost to the surrounding air.

Get the clutter out of your car trunk. Remember, every extra 100 pounds costs you about one percent in fuel economy for the average car, one and one-quarter percent for small cars.

Keep the cool air inside your refrigerator and save energy. Check the seals around the door. If they aren't tight enough to keep a dollar bill from slipping through easily, adjust the latch or replace the seal.

If the time has come to turn your heat on, set the thermostat at energy-economical settings ...65 degrees during the day, 55 degrees at night.

If you have an electric stove, save energy by using it wisely. Turn off burners several minutes before the end of the required cooking period. The heating element will stay hot, and your food will finish cooking without using any more electricity.

Don't waste hot water in your dishwasher. The average dishwasher uses 14 gallons of hot water per load. To use it economically, be sure the dishwasher is full when you turn it on.

Proper insulation can save you from 20 to 30 percent on your heating and cooling bills.

Chances are as the weather gets cooler you will be doing more roasting and baking. Use your oven energy efficiently. Prepare all-oven-cooked meals, or use extra space to prepare other dishes that can be used later with a little warming up.

Whenever you buy a new appliance, study the owner's manual and follow its maintenance and operating instructions carefully. You'll increase the life of your appliance, and its energy-efficiency.

Have you checked the dust bag in your vacuum cleaner lately? If it's full, empty or replace it. A full dust bag reduces suction, increases vacuuming time -- and wastes energy.

Have you checked your car's wheel alignment lately? Improper front wheel toe-in alignment can cost you as much as three-tenths of a mile per gallon of gas.

Keep your air conditioner thermostat at around 80 degrees, and save energy and cooling costs. If you keep your home six degrees cooler on warmer days you may pay as much as 47 percent more in utility bills.

Use your car air conditioner sparingly, and save gasoline. At normal speeds, the cooling equipment reduces fuel economy about 2 ½ miles per gallon.

Save energy when you're doing yard work. If you use gasoline-powered equipment, turn it off whenever you take a break. Letting the motor idle simply wastes gas.

You can cut as much as 80 percent of the solar heat gain in your home simply by keeping the sun out. Shade windows from the outside with louvered or canvas awnings. Or keep draperies and inside shades down.

Don't let sediment build up in the bottom of your hot water heater -- it lowers the heater's efficiency and wastes energy. About once a month flush the sediment out by drawing several buckets of water from the tank through the faucet near the bottom.

When you turn your air conditioner on, DON'T set the thermostat at a cooler setting than normal and expect it to cool more rapidly. It won't cool more rapidly, but it will cool to a lower temperature than you need -- and use more energy.

Dress sensibly for warmer weather. Did you know a light-weight skirt feels about a degree and a half cooler than light-weight slacks? And a short sleeved shirt feels about 8/10ths of a degree cooler than a long-sleeved shirt.

Keep lamps, TV sets and other heat-generating appliances away from your air conditioning thermostats. Otherwise the air conditioner will run longer than it needs to to maintain the temperature you want throughout the house. That wastes energy and increases cooling costs.

During hot weather, try serving the family more cold dishes and salads in place of cooked meals. Your home will stay cooler -- and you'll use less cooking and cooling energy.

Drive at a steady speed and save gasoline. On the highway, varying speeds by only 5 miles per hour can cost you about 1.3 miles per gallon.

Reduce energy consumption and cooling expenses by reducing the heat build-up in your home during the hottest part of the day. Do as much cooking as possible and use heat-generating equipment in the cooler early morning and late evening hours.

Did you know that pilot lights for gas stove burners and ovens burn about 1/3re of all the gas used for residential cooking? Make sure yours are properly adjusted - they could be burning more fuel than is necessary.

During long summer days you need less artificial light. In just five hours, two 100-watt bulbs use 11,600 British thermal units of energy -- or the equivalent of one pound of coal or one-half pint of oil Keep lights off unless you really need them.

If you have a room air conditioner make sure the fresh air intake is closed off during the hottest part of the day. Otherwise you're constantly cooling hot outside air, and that's energy-wasteful and expensive.

Thaw frozen foods the energy-economical way -- in the refrigerator. As the food defrosts, it reduces the load on the refrigerator's motor, and that saves energy.

You'll save energy and money if your windows are air-tight. Here's an easy way to check them. On a cold day, run your fingers around the windows. If you can feel cold air blowing in through cracks between the window frame and the wall, caulk the cracks. If air blows in between the window sash and frame, or between the upper and lower sashes, weatherstrip the windows.

Solar energy is free. Take advantage of it. In cool weather, during the day, open the drapes, shades, and shutters to let the sun shine in. But close them at night to minimize heat loss.

You may be keeping your refrigerator and freezer too cold, and that wastes energy. Check your manuals for the correct temperatures and adjust your appliances' thermostats accordingly.

Save electricity by doing as much ironing as possible at one time. A lot of energy goes into heating the iron initially.

Remember to check the air pressure in your tires. Air contracts in cold weather and your tires may be underinflated. Underinflated tires put an extra drag onthe engine and increase the car's gas consumption by about 2 percent per pound of air pressure decreased.

Are there leaves all over your yard? Begin a compost pile. Natural compost will save you money and a trip to the store for artificial varieties.

Have you checked and cleaned the outside exhaust of your clothes dryer lately? A clogged exhaust lengthens drying time -- and increases energy consumption.

Save hot water by installing an aerator on your kitchen sink faucet. This reduces the volume of water per minute -- but in's hardly noticable.

Clean your self-cleaning oven while it is still warm from cooking. Your oven will need less heat to reach the required cleaning temperature -and you'll save energy.

A dirty thermostat will not maintain proper indoor temperatures. That could cost you fuel money. If you haven't checked your thermostat lately, remove the cover and carefully blow away the dust.

Try carpooling to the supermarket with a neighbor. By taking only one car you'll save gasoline -- and have the pleasure of a friend's company.

Don't always rely on the automobile. Walk, take a bus, ride a bicycle when you can. Vacation trips do not have to revolve around the car. Consider other ways of traveling.

Plan to use public transportation. Check the schedules and routings; call your local company if the current routes do not meet your needs. Make the building of better public transportation systems a priority in your community.

Try to make one less car trip a week. Plan your shopping and medical appointments together, if possible. Consciously think: Do I have to use the car for this trip?

Organize car pools. It might be at least as convenient to travel with others to work, school, or shopping.

Reduce speed on highways when possible.

Drive smoothly, avoid excess braking, slow down if possible before stepping on the brakes.

Don't idle your engine unnecessarily. It should not run longer than 3 minutes while you're waiting, In cold weather, drive slowly for the first quarter-mile instead of idling. Racing the engine also wastes gasoline.

Keep your car maintained in good condition. Have the automobile periodically checked for repairs and upkeep, and keep the engine cleaned and properly tuned. You'll save on gasoline this way.

Keep your tires properly inflated. This helps gasoline mileage. Radial tires also help conserve gasoline.

Encourage proper filling of your gasoline tank. Don't let service station attendants overfill your gank so that gasoline is wasted. This is an appreciable source of air pollution.

Use car air conditioners wisely. Think about how necessary it is to turn it on before you flip that switch. If possible, don't use it. When you do, set the temperature at the warmest level that is still comfortable.

Use low or no-lead gas, if possible. Find out from a mechanic or your salesman if your car can use it before buying. Find out what octane rating your car needs and don't buy a higher one. Gas stations now post this rating on pumps.

Heating. You'll save money and energy if you lower the thermostat a few degrees and wear heavier clothing, close the draperies at night, keep the fireplace damper closed, don't heat empty rooms, keep your furnace in good condition, fix leaky faucets, prevent drafts from open windows and attic doors.

Cooling. Remember to raise the thermostat a few degrees and wear lighter clothing, open windows when you can instead of running the air conditioner, turn off unnecessary lights, close draperies during day.

Appliances. Don't run items such as dishwashers or clothers dryers during the day if you can avoid it, and fill them up before you use them. Unplug instant-on TV sets. Wash dishes and clothes in warm water, Don't leave the radio or TV on when you're not listening.

Don't buy more than you need. Avoid buying too large an item, such as a refrigerator or air conditioner, if you will not use it to capacity.

Look for energy-efficient products. Think about energy efficiency in the things you purchase, such as refrigerators (the frost-free models consume twice as much energy), air conditioners, and lighting (you'll save with fluorescent lights). If you install weather stripping and storm windows, or add insulating materials when you remodel your home, you'll improve insulation and save on the fuel bill.

Buy to conserve. Self-cleaning ovens and crushed-ice dispensers in refrigerators, for example, waste more energy. If you don't need accessories, don't buy them.